

Quality Report



Generated with Pix4Dmapper version 4.6.3



Important: Click on the different icons for:



Help to analyze the results in the Quality Report



Additional information about the sections



Click [here](#) for additional tips to analyze the Quality Report

Summary



Project	3cm
Processed	2020-12-18 14:59:52
Camera Model Name(s)	FC6310_8.8_5472x3648 (af3db2b889473336bf5a97c5679ad478) (RGB)
Average Ground Sampling Distance (GSD)	2.98 cm / 1.17 in
Area Covered	0.237 km ² / 23.6773 ha / 0.09 sq. mi. / 58.5383 acres

Quality Check



Images	median of 23995 keypoints per image	
Dataset	96 out of 96 images calibrated (100%), all images enabled	
Camera Optimization	0.04% relative difference between initial and optimized internal camera parameters	
Matching	median of 7207.17 matches per calibrated image	
Georeferencing	yes, 5 GCPs (5 3D), mean RMS error = 0.219 m	

Preview

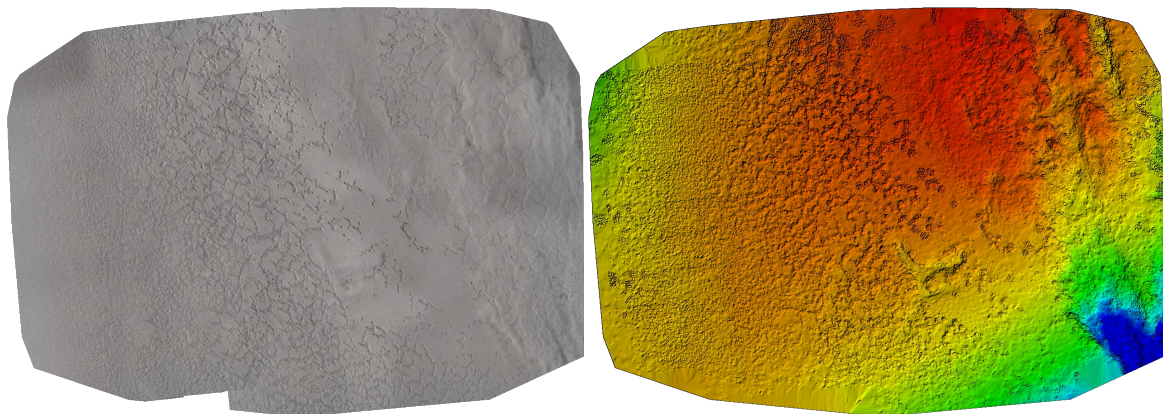


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details



Number of Calibrated Images	96 out of 96
Number of Geolocated Images	96 out of 96

Initial Image Positions



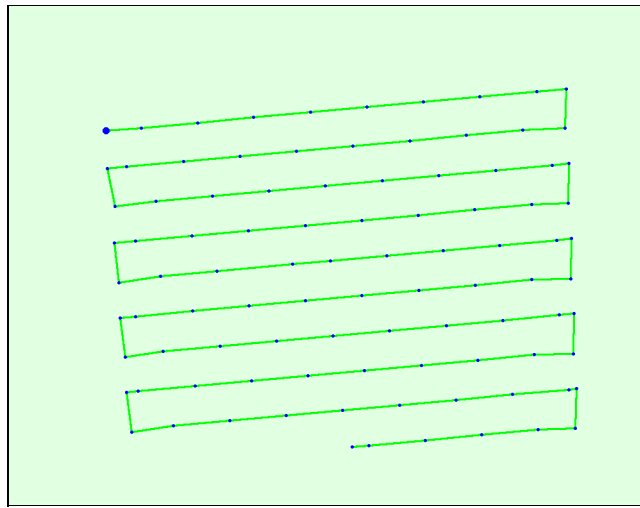
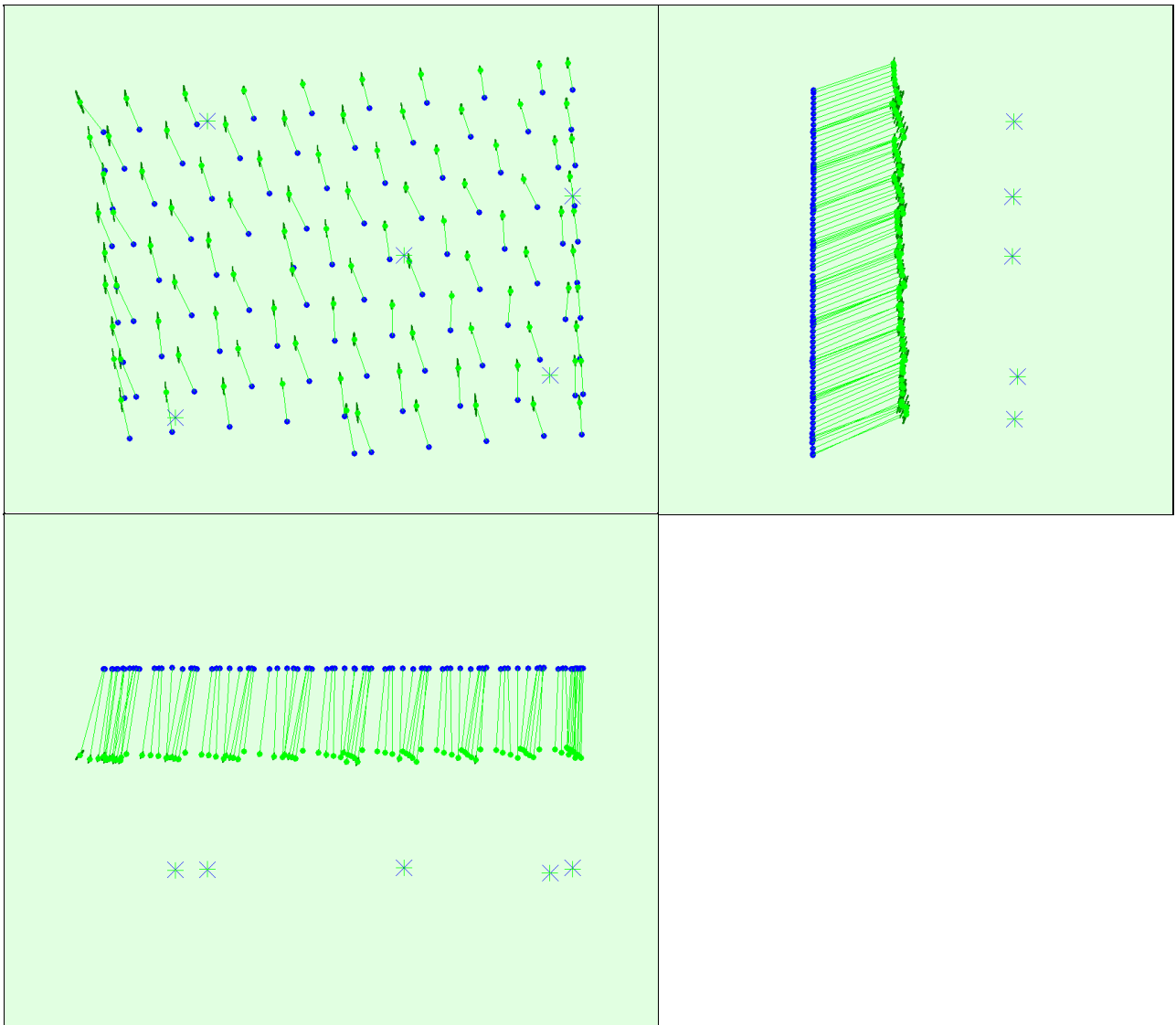


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



Uncertainty ellipses 10x magnified

Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.

? Absolute camera position and orientation uncertainties



	X[m]	Y[m]	Z[m]	Omega [degree]	Phi [degree]	Kappa [degree]	Camera Displacement X[m]	Camera Displacement Y[m]	Camera Displacement Z[m]
Mean	0.073	0.654	0.216	0.350	0.027	0.014	0.016	0.103	0.319
Sigma	0.036	0.182	0.081	0.103	0.016	0.008	0.009	0.038	0.089

? Overlap

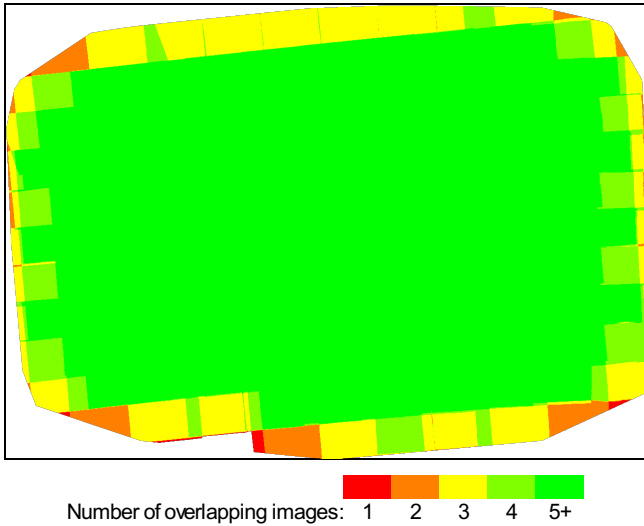


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

Bundle Block Adjustment Details



Number of 2D Keypoint Observations for Bundle Block Adjustment	1052378
Number of 3D Points for Bundle Block Adjustment	326469
Mean Reprojection Error [pixels]	0.205

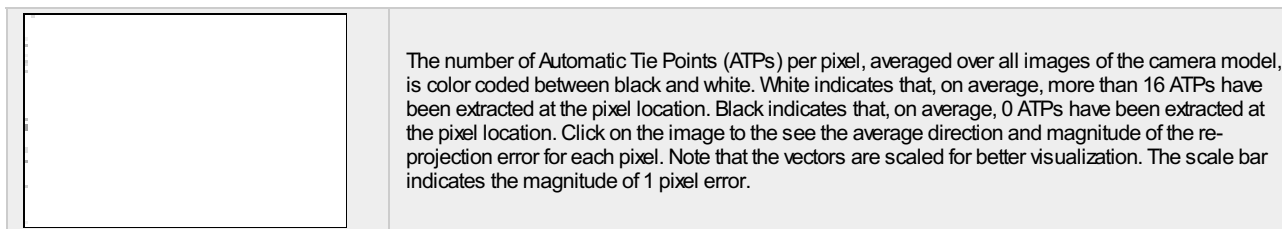
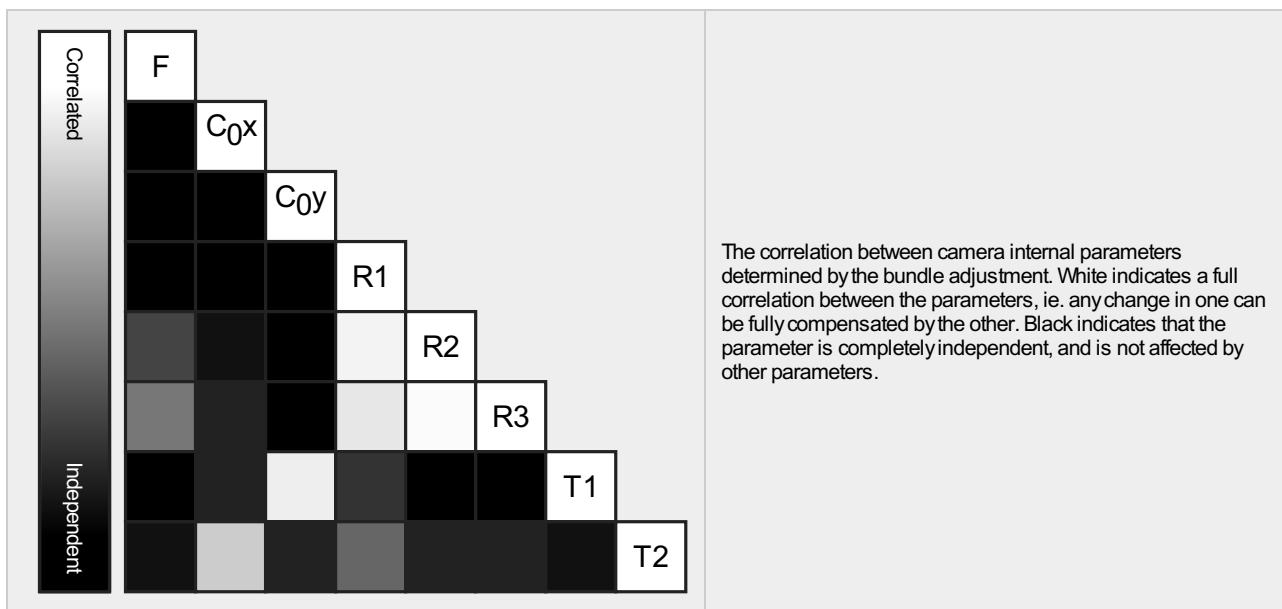
? Internal Camera Parameters

✎ FC6310_8.8_5472x3648 (af3db2b889473336bf5a97c5679ad478) (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]



EXIF ID: FC6310_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3752.230 [pixel] 8.800 [mm]	2736.000 [pixel] 6.417 [mm]	1824.000 [pixel] 4.278 [mm]	0.000	0.000	0.000	0.000	0.000
Optimized Values	3754.100 [pixel] 8.804 [mm]	2735.104 [pixel] 6.415 [mm]	1822.054 [pixel] 4.273 [mm]	0.003	-0.014	0.014	-0.000	0.001
Uncertainties (Sigma)	0.927 [pixel] 0.002 [mm]	0.923 [pixel] 0.002 [mm]	0.926 [pixel] 0.002 [mm]	0.000	0.001	0.001	0.000	0.000



2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	23995	7207
Mn	20317	2797
Max	42219	26907
Mean	28192	10962

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	162340
In 3 Images	66234
In 4 Images	37630
In 5 Images	23722
In 6 Images	15313
In 7 Images	9705
In 8 Images	6141
In 9 Images	3592
In 10 Images	1180
In 11 Images	548
In 12 Images	63
In 13 Images	1

2D Keypoint Matches

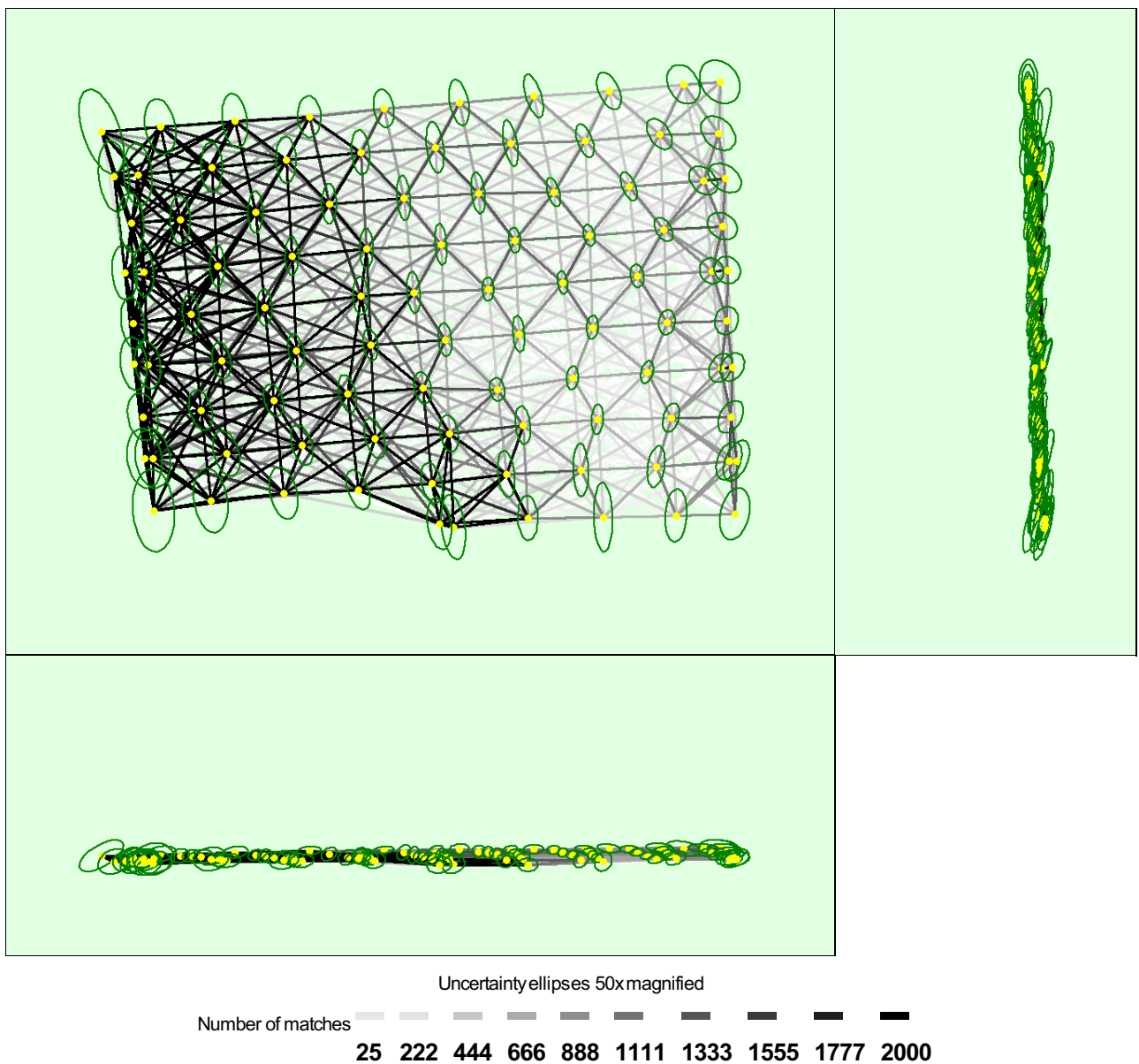


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result.

Relative camera position and orientation uncertainties

	X[m]	Y[m]	Z[m]	Omega [degree]	Phi [degree]	Kappa [degree]	Camera Displacement X[m]	Camera Displacement Y[m]	Camera Displacement Z[m]
Mean	0.160	0.307	0.101	0.188	0.063	0.050	0.066	0.096	0.168
Sigma	0.056	0.096	0.038	0.056	0.015	0.009	0.017	0.015	0.046

Geolocation Details

Ground Control Points

GCP Name	Accuracy XY/Z [m]	Error X[m]	Error Y[m]	Error Z[m]	Projection Error [pixel]	Verified/Marked
WtoDroneNorth1 (3D)	0.020/0.020	0.007	-0.052	-0.590	1.005	6 / 6
WtoDroneNorth2 (3D)	0.020/0.020	-0.225	0.159	0.936	3.510	8 / 8
WtoDroneNorth3 (3D)	0.020/0.020	0.004	-0.034	-0.080	0.943	9 / 9
WtoDroneNorth4 (3D)	0.020/0.020	-0.024	0.074	0.159	1.564	8 / 8

WtoDroneNorth5 (3D)	0.020/ 0.020	-0.002	0.004	0.024	1.005	9 / 9
Mean [m]		-0.048013	0.030077	0.089672		
Sigma [m]		0.089236	0.077391	0.493055		
RMS Error [m]		0.101333	0.083030	0.501143		

Localisation accuracy per GCP and mean errors in the three coordinate directions. The last column counts the number of calibrated images where the GCP has been automatically verified v.s. manually marked.

? Absolute Geolocation Variance



Mn Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.00	0.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	3.13	1.04	0.00
-9.00	-6.00	9.38	2.08	4.17
-6.00	-3.00	20.83	19.79	17.71
-3.00	0.00	14.58	25.00	26.04
0.00	3.00	20.83	33.33	32.29
3.00	6.00	16.67	13.54	16.67
6.00	9.00	10.42	5.21	3.13
9.00	12.00	3.13	0.00	0.00
12.00	15.00	1.04	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		8.328722	-31.455609	81.313756
Sigma [m]		5.321816	3.463325	3.413660
RMS Error [m]		9.883792	31.645694	81.385380

Min Error and Max Error represent geolocation error intervals between -1.5 and 1.5 times the maximum accuracy of all the images. Columns X, Y, Z show the percentage of images with geolocation errors within the predefined error intervals. The geolocation error is the difference between the initial and computed image positions. Note that the image geolocation errors do not correspond to the accuracy of the observed 3D points.

Geolocation Bias	X	Y	Z
Translation [m]	8.328722	-31.455609	81.313756

Bias between image initial and computed geolocation given in output coordinate system.

? Relative Geolocation Variance



Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	57.29	82.29	100.00
[-2.00, 2.00]	95.83	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	5.000000	5.000000	10.000000
Sigma of Geolocation Accuracy [m]	0.000000	0.000000	0.000000

Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

Geolocation Orientational Variance	RMS [degree]
Omega	17.607
Phi	1.228
Kappa	1.044

Geolocation RMS error of the orientation angles given by the difference between the initial and computed image orientation angles.

? Rolling Shutter Statistics



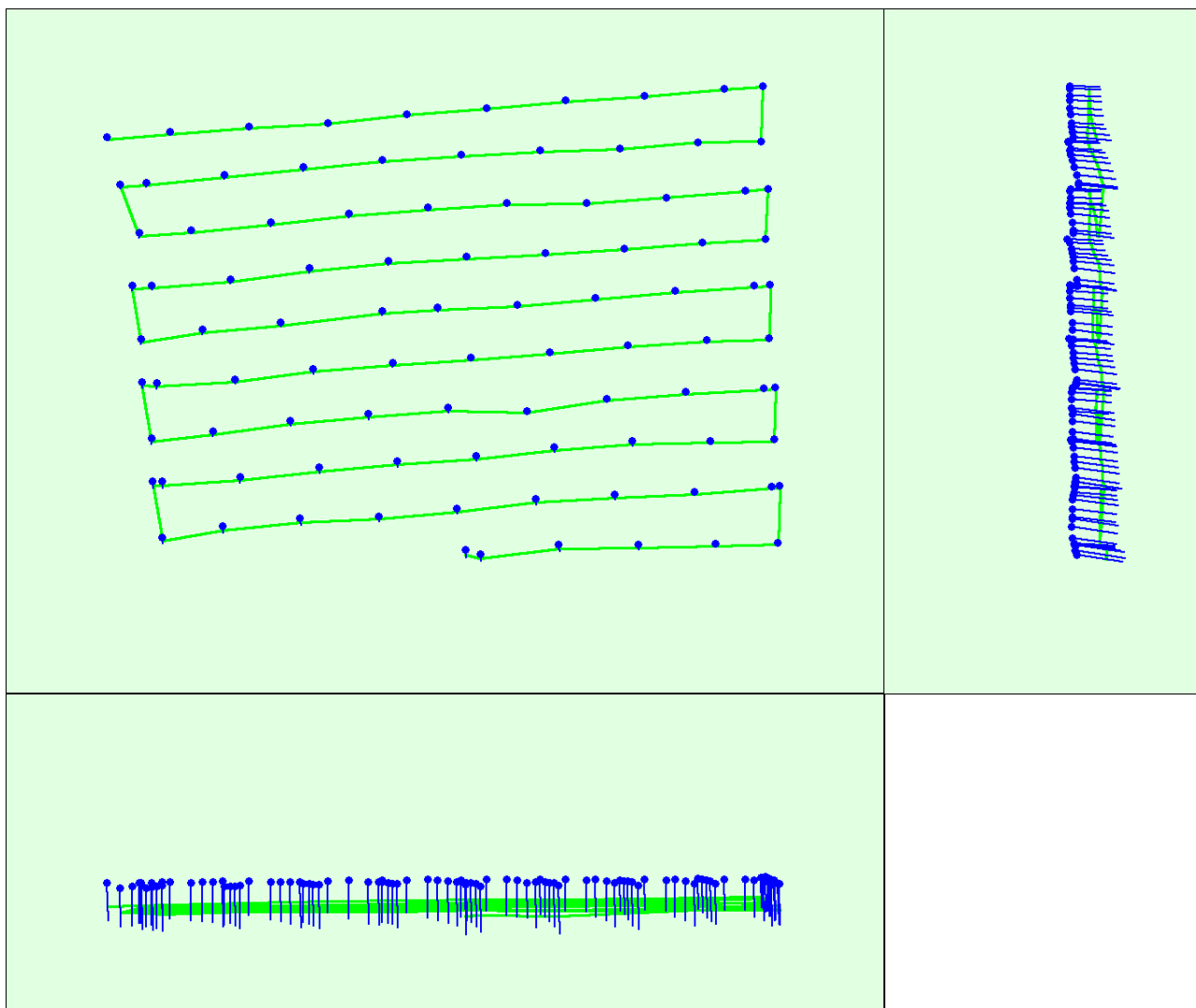


Figure 6: Camera movement estimated by the rolling shutter camera model. The green line follows the computed image positions. The blue dots represent the camera position at the start of the exposure. The blue lines represent the camera motion during the rolling shutter readout, re-scaled by a project dependant scaling factor for better visibility.

Median Camera Speed	9.1681 [m/s]
Median Camera Displacement During Sensor Readout)	34.5201 [m]
Median Rolling Shutter Readout Time	4023.2578 [ms]

Initial Processing Details



System Information



Hardware	CPU: AMD Ryzen 5 2600 Six-Core Processor RAM: 16GB GPU: Radeon RX550/550 Series (Driver: 27.20.12033.1007)
Operating System	Windows 10 Education, 64-bit

Coordinate Systems



Image Coordinate System	WGS 84 (EGM96 Geoid)
Ground Control Point (GCP) Coordinate System	WGS 84 / UTMzone 19S (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTMzone 19S (EGM96 Geoid)

Processing Options



Detected Template	No Template Available
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Keypoints Image Scale	Full, Image Scale: 1
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Geolocation Based Internal Parameters Optimization: All prior External Parameters Optimization: All Rematch: Auto, yes

Point Cloud Densification details



Processing Options



Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Optimal
Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: no
LOD	Generated: no
Advanced: 3D Textured Mesh Settings	Sample Density Divider: 1
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	45m:11s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	05m:08s

Results



Number of Generated Tiles	1
Number of 3D Densified Points	17097100
Average Density (per m ³)	121.42

DSM, Orthomosaic and Index Details



Processing Options



DSM and Orthomosaic Resolution	1 x GSD (2.98 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: no GeoTIFF Without Transparency: no Google Maps Tiles and KML: yes
Index Calculator: Reflectance Map	Generated: yes Resolution: 1 x GSD (2.98 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	grayscale
Time for DSM Generation	08m:33s
Time for Orthomosaic Generation	25m:26s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:23m:06s
Time for Index Map Generation	03m:32s

